

WHAT IS CLAIMED IS:

1. An optical cross-connect apparatus for performing non-blocking optical cross-connection of n WDM input optical signals each containing m different wavelengths λ_1 through λ_m , the apparatus comprising:

n first wavelength converters for converting the m different wavelengths λ_1 through λ_m contained in the WDM input optical signals into $2m$ wavelengths λ_1 through λ_{2m} ;

10 a first wavelength cross-connector for performing cross-connection according to wavelengths, the cross-connector including:

n first demultiplexers for separating the optical signals wavelength-converted by the first wavelength converters into $2m$ wavelengths, and

n first multiplexers for combining optical signals with the $2m$ separated wavelengths,

wherein same wavelengths should not be sent via each of bundles of $2m/n$ lines by which the first demultiplexers and the first multiplexers are connected;

n second wavelength converters for converting the $2m$ wavelengths contained in the optical signals cross-connected by the first wavelength cross-connector into $2m$ wavelengths;

25 a second wavelength cross-connector for performing cross-connection according to wavelengths, the cross-connector including:

n second demultiplexers for separating the optical signals wavelength-converted by the second wavelength converters into $2m$ wavelengths, and

n second multiplexers for combining optical signals with the $2m$ separated wavelengths,

wherein same wavelengths should not be sent via each of bundles of $2m/n$ lines by which the second demultiplexers and the second multiplexers are connected; and

n third wavelength converters for converting the $2m$ wavelengths λ_1 through λ_{2m} contained in the optical signals cross-connected by the second wavelength cross-connector into m wavelengths λ_1 through λ_m and for sending the m wavelengths λ_1 through λ_m .

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2. An optical cross-connect apparatus for performing non-blocking optical cross-connection of n WDM input optical signals each containing m different wavelengths λ_1 through λ_m , the apparatus comprising:

n first wavelength converters for converting the m different wavelengths λ_1 through λ_m contained in the WDM input optical signals into $2m$ wavelengths λ_1 through λ_{2m} ;

a first wavelength cross-connector for performing cross-connection according to wavelengths, the cross-connector including:

n first demultiplexers for separating the optical signals wavelength-converted by the first

wavelength converters into $2m$ wavelengths, and

$2n$ first multiplexers for combining optical signals with m separated wavelengths,

wherein same wavelengths should not be sent
5 via each of bundles of m/n lines by which the first demultiplexers and the first multiplexers are connected;

$2n$ second wavelength converters for converting the m wavelengths contained in the optical signals cross-connected by the first wavelength cross-connector into m
10 wavelengths;

a second wavelength cross-connector for performing cross-connection according to wavelengths, the cross-connector including:

$2n$ second demultiplexers for separating the
15 optical signals wavelength-converted by the second wavelength converters into m wavelengths, and

n second multiplexers for combining optical signals with the $2m$ separated wavelengths,

wherein same wavelengths should not be sent
20 via each of bundles of m/n lines by which the second demultiplexers and the second multiplexers are connected;
and

n third wavelength converters for converting the $2m$ wavelengths λ_1 through λ_{2m} contained in the optical
25 signals cross-connected by the second wavelength cross-connector into m wavelengths λ_1 through λ_m and for sending the m wavelengths λ_1 through λ_m .

3. An optical cross-connect apparatus for performing non-blocking optical cross-connection of n WDM input optical signals each containing m different wavelengths λ_1 through λ_m , the apparatus comprising:

n first wavelength converters for converting the m different wavelengths λ_1 through λ_m contained in the WDM input optical signals into $(2m-1)$ wavelengths λ_1 through λ_{2m-1} ;

a first wavelength cross-connector for performing cross-connection according to wavelengths, the cross-connector including:

n first demultiplexers for separating the optical signals wavelength-converted by the first wavelength converters into $(2m-1)$ wavelengths, and

$(2m-1)$ first multiplexers for combining optical signals with n separated wavelengths,

wherein each of the first demultiplexers is connected to each of the first multiplexers by one line;

$(2m-1)$ second wavelength converters for converting the n wavelengths contained in the optical signals cross-connected by the first wavelength cross-connector into n wavelengths;

a second wavelength cross-connector for performing cross-connection according to wavelengths, the cross-connector including:

$(2m-1)$ second demultiplexers for separating

the optical signals wavelength-converted by the second wavelength converters into n wavelengths, and

n second multiplexers for combining optical signals with $(2m-1)$ separated wavelengths,

5 wherein each of the second demultiplexers is connected to each of the second multiplexers by one line; and

n third wavelength converters for converting the $(2m-1)$ wavelengths λ_1 through λ_{2m-1} contained in the optical signals cross-connected by the second wavelength cross-connector into m wavelengths λ_1 through λ_m and for sending the m wavelengths λ_1 through λ_m .

4. An optical cross-connect apparatus for performing non-blocking optical cross-connection of n WDM input optical signals each containing m different wavelengths λ_1 through λ_m , the apparatus comprising:

n input-side wavelength converters for converting the m different wavelengths λ_1 through λ_m contained in the WDM input optical signals into mn wavelengths λ_1 through λ_{mn} ;

a wavelength cross-connector for performing cross-connection according to wavelengths, the cross-connector including:

25 n demultiplexers for separating the optical signals wavelength-converted by the input-side wavelength converters into mn wavelengths, and

n multiplexers for combining optical signals
with the mn separated wavelengths,

wherein same wavelengths should not be sent
via each of bundles of m lines by which the demultiplexers
5 and the multiplexers are connected; and

n output-side wavelength converters for converting
the mn wavelengths λ_1 through λ_{mn} contained in the optical
signals cross-connected by the wavelength cross-connector
into m wavelengths λ_1 through λ_m and for sending the m
10 wavelengths λ_1 through λ_m .

5. An optical cross-connect apparatus for performing
optical cross-connection of n WDM input optical signals
each containing m different wavelengths λ_1 through λ_m , the
15 apparatus comprising:

n input-side wavelength converters for converting
the m different wavelengths λ_1 through λ_m contained in the
WDM input optical signals into m wavelengths;

a wavelength cross-connector for performing cross-
20 connection according to wavelengths, the cross-connector
including:

n demultiplexers for separating the optical
signals wavelength-converted by the input-side wavelength
converters into m wavelengths, and

25 n multiplexers for combining optical signals
with the m separated wavelengths; and

n output-side wavelength converters for converting

the m wavelengths contained in the optical signals cross-connected by the wavelength cross-connector into m wavelengths λ_1 through λ_m and for sending the m wavelengths λ_1 through λ_m .